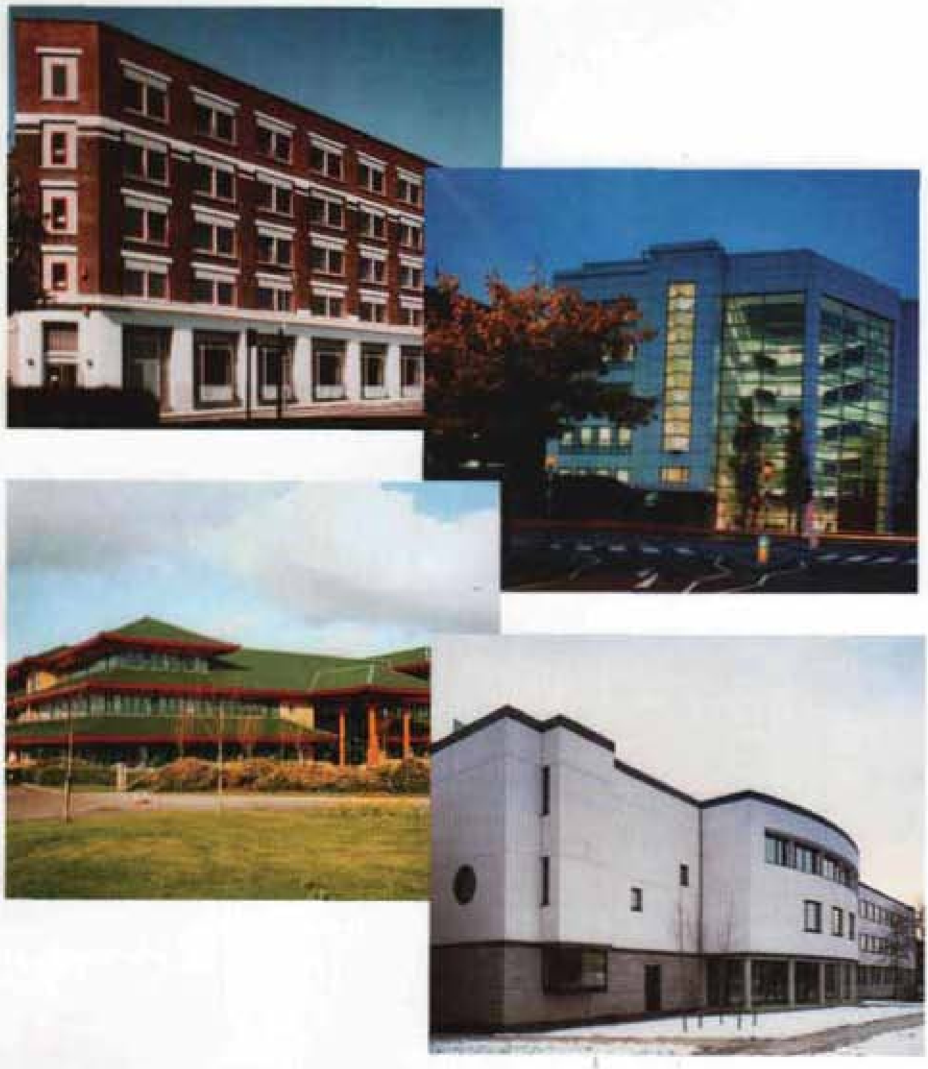
DETR
Environment
Transport
Regions

GOOD PRACTICE GUIDE 274

Environmentally smart buildings

– a quantity surveyor's guide to the cost-effectiveness of energy-efficient offices



- Cut capital costs while enhancing energy efficiency
- Provide an enhanced service to clients through value management
- Help clients improve their corporate image

BEST PRACTICE PROGRAMME

ENERGY EFFICIENCY

BEST PRACTICE
PROGRAMME

GOOD PRACTICE GUIDE 274

CONTENTS

1 INTRODUCTION

Energy-efficient buildings are expensive. True or False?

If your knowledge of energy-efficient buildings has been influenced by publicity about high-profile innovative buildings then your answer to this question may well be 'true'. The reality is that energy-efficient buildings can be cheaper to construct and are, of course, cheaper to run than conventional buildings. Even where the capital costs of energy efficiency measures are higher, these can usually be traded off against far lower running costs.

In recent surveys of clients, environmental issues were judged to be second only in importance to location. This means that there is a wide gulf between most quantity surveyors (QSs) and their clients in their perceptions of the value of energy efficiency. It isn't simply an issue of reducing energy costs by lowering energy consumption. There is also a direct relationship between energy use and environmental impact. Environmental awareness is being embraced by many organisations as part of their marketing and profiling strategies.

This Guide aims to provide the QS with the information needed to bridge this gap and so provide a more valuable service to clients.

THE VALUE OF THIS GUIDE TO THE QS

After reading this Guide, the QS will be able to:

- help clients save money by delivering optimum value for money
- understand and utilise the cost-saving trade-offs possible with energy-efficient buildings
- improve client confidence by setting and using accepted benchmarks for performance in use
- improve the service offered on Private Finance Initiative (PFI) contracts by considering life-cycle costing
- help clients improve their corporate image.

Examples of the benefits of environmentally smart buildings are illustrated by the case studies on page 17.

A summary of the key points addressed by this Guide is shown on page 19.

Client surveys, by Richard Ellis and Stanhope plc, showed environmental issues to be the second most important factor for clients after location.

Another survey of QSs revealed that they overestimate the on-costs of energy efficiency measures, and underestimate the potential for cost savings as trade-offs. In this survey, less than 4% of QSs saw the need for anything other than cost information when describing energy efficiency measures.

Perhaps they are missing a trick or two!

2 ENERGY EFFICIENCY IS NOT AN OPTIONAL EXTRA

CLIENT EXPECTATIONS

The QS cannot afford to be complacent about the role of energy efficiency in buildings – it is not an optional extra. Clients know that energy-efficient buildings can, in addition to saving capital and running costs, improve their corporate image, help to increase worker satisfaction and productivity[1] and even reduce the cost of the climate change levy.

The value of hidden assets

Traditionally, the market value of property has been judged in terms of location, quality, function and aesthetics while the value of energy efficiency, a less visible asset, has largely been ignored. However, such benefits as natural ventilation, good daylighting, and occupant-sensitive controls are actually very desirable to the market. The importance of these features is verified by surveys which show that people are uncomfortable in deep-plan air-conditioned spaces which allow them little control over their own environment[1].

While it is difficult to set an actual value on these features, most accept that a good working environment leads to an increase in productivity, and this can have considerable economic value. It is, therefore, important that the QS recognises the value of environmental benefits to his clients in the same way that he understands the value of cost savings.

Environmental features

Many clients are now keen to use the 'greenness' of their building as a marketing feature and therefore want to attach a value to its energy efficiency characteristics. In practice it is not straightforward to do this, although labelling schemes like BREEAM (Building Research Establishment Environmental Assessment Method) can be of some help. BREEAM works by awarding credits to features of a building that lead to its having less environmental impact than a typical building. Energy-efficient buildings substantially reduce greenhouse gas emissions, acid gas emissions and toxic air pollution and tend to score well under BREEAM 1998 for Offices.
Some organisations are also developing corporate energy policies[2] – another indication of how seriously clients are beginning to take their environmental responsibilities.

There are a number of pressures acting on businesses to make them increase their environmental awareness.

- Green issues are becoming significant politically. International treaties, European and UK legislation are being introduced to reflect an agenda of sustainable development.
- Building Regulations and industrial emission and waste standards are also becoming stricter and the construction industry (as a major polluter) is coming under increasing pressure.
- Energy taxes are being considered by government.
- In addition 'green' consumers and ethical investors are now demanding that organisations attain good environmental credentials.

BREEAM

For further information on BREEAM contact:
The BREEAM Office
BRE, Garston
Watford WD2 7JR
Tel 01923 664462
Fax 01923 664103
E-mail breeam@bre.co.uk

3 HOW THE QS CAN PROVIDE AN ENHANCED SERVICE TO CLIENTS

Energy efficiency is a low-risk investment

Once the QS accepts the true value of energy efficiency, there is a real opportunity for him to provide an enhanced service to his clients. First, however, he needs to understand his role in the design team and then to get to grips with some simple facts and concepts about energy efficiency and the marketing benefits to the client. Appreciation of these issues will equip the QS to offer a value management service based on life-cycle costings (covered further in section 5), not just on lowest capital costs.

GET INVOLVED

It is crucial for the QS to become fully involved as a member of the design team at the project's inception, when the client is preparing the design brief and before the design is fixed in the designers' minds. This is often when the most economical measures can be introduced. The Government's Design Advice service can help with strategic level advice on the most suitable measures for each project (see the tinted box on the left). Thereafter, the QS should play an active role within the design team throughout the design and construction of the building. The opportunities that these roles present to the QS are discussed in more detail below.

WORK WITH THE CLIENT

Before the QS can give the client sound financial advice about implementing energy efficiency measures in a building, both the client's view of energy efficiency as an investment, and the value of energy efficiency to different markets must be understood.

Understand the client

Different clients have different investment criteria which are often related to the nature of their business. Once the client understands these different criteria for energy efficiency investments, the QS can tailor the advice accordingly.

Public sector organisations and some larger organisations invest in buildings over the long term and will accept long payback periods (20 years) and relatively low rates of return on investments (say 5-7%).

City investors, on the other hand, may demand rapid returns on their investments and expect payback periods as short as one year on energy efficiency measures. In reality, however, such high-risk businesses seldom achieve more than a 20% return per year (approximately a five-year payback) on their mainstream business – and energy efficiency is a much lower risk.

In general, most businesses are between these extremes and will accept payback periods of between three and seven years for very-low-risk investments such as energy efficiency measures.

Owner-occupiers, and many public sector occupiers operating under PFI contract conditions, will also take a long-term view, as they have an interest in a building over its whole life and not just at the new-build stage. In this case, the QS is well placed to provide a comprehensive life-cycle costing service for the client.

Life-cycle costing normally includes:

- site and procurement costs (and/or income)
- design and construction costs
- tax concessions
- rental costs (and/or income)
- energy and utility costs
- repair and maintenance costs
- refurbishment costs.

Understand the market value of energy efficiency/environmental issues

As discussed earlier, a good corporate image is important to most successful organisations, and as pressure to protect the environment grows companies must be seen to respond.

Assess energy efficiency measures

Once the financial expectations of the client and the value of energy efficiency are fully understood the QS can then advise on the brief and ensure that sensible low-energy design measures are specified.

If the QS can fully understand the financial viewpoint of the client – and advise on a realistic stance for the client's particular circumstances – then informed decisions about the building can be made in the best interests of the client. An environmentally smart building is always in the best interests of the client.

BEST PRACTICE PROGRAMME

DESIGN ADVICE

For further information on the Design Advice scheme contact:
Design Advice
BRE, Garston
Watford WD2 7JR
Tel 01923 664258
Fax 01923 664787

HOW THE QS CAN PROVIDE AN ENHANCED SERVICE TO CLIENTS

Figure 1 shows the building-related life-cycle costs (above the line), and returns (below the line), for an air-conditioned office from the viewpoint of the different stakeholders:

- the institutional investor
- the developer
- the tenant
- the owner-occupier.

Some of the key building-related life-cycle costs for each stakeholder in figure 1 are as follows.

Institutional investor

For the institutional investor most of the costs and returns over the life of the building are relevant, apart from running costs. Buying the site, constructing the building and maintaining the building are all costs. The rent received for the building is income, as is the value of the site. Although an investor seldom pays for the running costs (inclusive leases are unusual in the UK), there is an interest in keeping good tenants happy and owning a low-risk investment. Energy efficiency can help to achieve both of these.

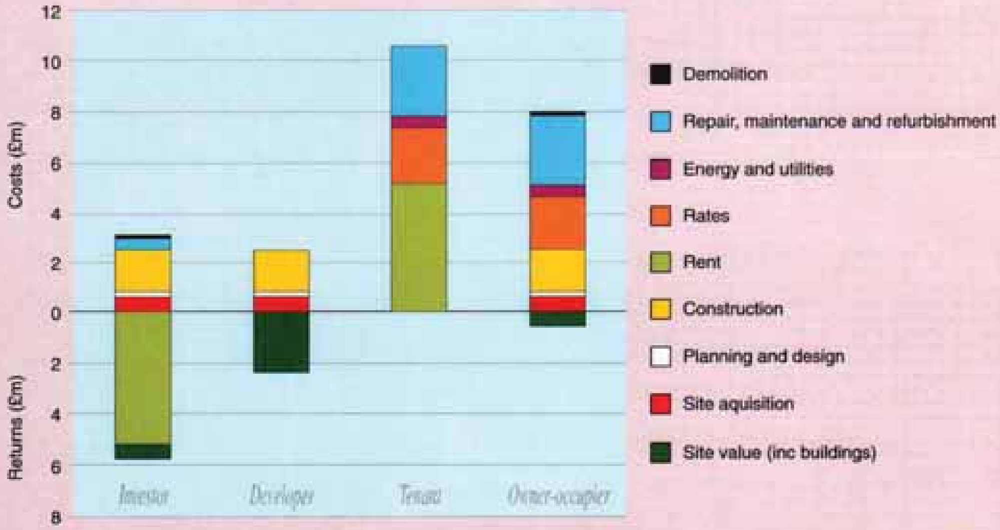


Figure 1 Building-related life-cycle costs and returns for a provincial air-conditioned office

Developer

The developer incurs all the costs (site cost, design and build), and receives all his revenue (site and building sale) at the beginning of the 60-year life of the building. As the building is worth more when it is new the dark green bar (in figure 1) for site value is larger for the developer than the owner or institutional investor. The developer's interest in energy efficiency is, therefore, only likely to focus on the marketing benefits at the time of the sale, ie 'energy efficiency' and 'environmentally smart' are labels that help a building to sell more quickly and for a higher price.

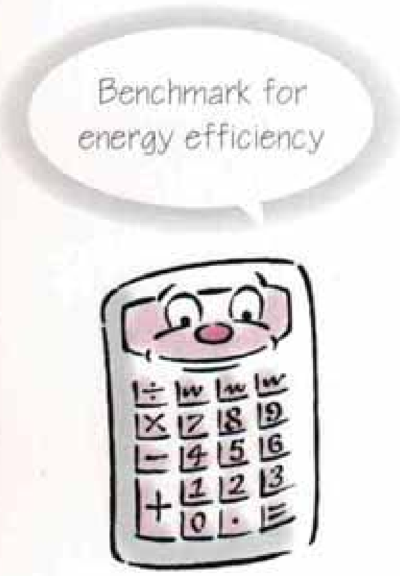
Tenant

The tenant pays the most for the use of the building over its life – and at the end the tenant also has no site to sell, therefore no dark green bar on figure 1. Energy is only a small proportion of the costs of occupying the building, and if considered in isolation is unlikely to motivate the tenant significantly towards energy savings. However, the occupant satisfaction with the comfort of the building will have a significant effect on the productivity of the company occupying the building. The costs associated with uncomfortable staff are significantly higher than the energy costs, and the building will become undesirable if it cannot provide a satisfactory thermal environment for its occupants.

Owner-occupier

For the owner-occupier (and some PFI partners), all of the costs and returns of the building are relevant, apart from rent. The analysis does show that owning a property works out cheaper than renting in the long term. Many owner-occupied buildings will have been designed or modified to ensure that they match the owner's needs. Owner-occupiers have a strong vested interest in energy efficiency, low running costs and a low environmental impact (ie a good BREEAM rating).

HOW THE QS CAN PROVIDE AN ENHANCED SERVICE TO CLIENTS



Keeping it simple

Clients should be encouraged not to over-specify their requirements; often the simplest solutions are the best. Energy and polluting emissions can be reduced by 30-50% (when compared with typical figures), simply by adopting tried and tested good practice in the design and operation of new office buildings.

Using benchmarks for real buildings

A quick way of specifying energy efficiency is to set targets based on energy benchmarks. Established industry-wide benchmarks of typical and good practice performance for offices of different designs are shown in table 1, derived from Energy Consumption Guide (ECON) 19[3]. The table shows delivered energy consumption and energy cost; in both cases these figures have been derived using performance figures from real buildings.
A target based on the good practice benchmark should be readily achievable. Benchmarks for other buildings can be found in the Energy Consumption Guide series available from BRECSU (see the back cover for details).

Energy consumption benchmarks should be set in terms of kWh/m^2 so that changing utility costs do not have to be taken into account. When using energy benchmarks as targets at the design stage, it is advisable to set slightly higher standards than those actually desired. This gives a margin of error that can be used to counteract a number of factors (often outside the control of the design team), that can prevent a building meeting its design performance level. Examples are:

- partitions and fit out that limit air movement across zones
- occupancy may not be uniform or to the levels envisaged
- high-energy (and heat-emitting) office equipment may be installed
- spaces may be used for activities that they were not designed for
- complex services may not be commissioned, controlled or maintained properly.

To ensure a building will actually perform within its design limits despite small construction flaws and real tenant interaction, a design has to be robust and flexible enough to cope with changing use patterns, etc.

	Naturally ventilated cellular office		Naturally ventilated open-plan office		Air-conditioned standard office		Air-conditioned city centre prestige office	
	Good practice	Typical	Good practice	Typical	Good practice	Typical	Good practice	Typical
ANNUAL CONSUMPTION	(kWh/yr/m^2)		(kWh/yr/m^2)		(kWh/yr/m^2)		(kWh/yr/m^2)	
Total gas or oil	79	151	79	151	97	178	114	210
Total electricity	33	54	54	85	128	226	234	358
ANNUAL COSTS	(£/m^2)		(£/m^2)		(£/m^2)		(£/m^2)	
Total gas or oil	0.95	1.81	0.87	1.66	0.97	1.78	1.03	1.89
Total electricity	2.48	4.05	3.51	5.53	7.04	12.43	11.70	17.90
Total energy cost	3.43	5.86	4.38	7.19	8.01	14.21	12.73	19.79
Assumed unit costs								
Gas (p/kWh)	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9
Electricity (p/kWh)	7.5	7.5	6.5	6.5	5.5	5.5	5.0	5.0

Table 1 Energy consumption and costs of typical and good practice offices (floor areas, in m^2, refer to treated floor area throughout in this table)

4 ENERGY EFFICIENCY MEASURES DO NOT ALWAYS COST MORE

ACHIEVING BETTER VALUE ENERGY-EFFICIENT BUILDINGS

This document demonstrates how the involvement of an informed QS at the design stage can produce energy-efficient buildings that:

- cost no more to build than inefficient ones (less in some cases)
- have lower running costs
- prove to be easy to run, pleasant and productive places to inhabit
- have low environmental impact.

It is usually possible to design attractive, uncomplicated buildings which operate in a straightforward manner, achieve high standards of energy efficiency and incur no additional costs. If the QS is to contribute effectively to this process, the value of introducing energy efficiency measures at the inception stage and recognition of the importance of treating the measures as a package rather than in isolation needs to be understood. Furthermore, the QS should also be familiar with which packages can show capital cost savings at the same time as improving energy efficiency. Most of the key decisions taken at inception permit significant cost savings as well as energy cost savings, as demonstrated in figures 2 and 3 (pages 11 and 12), and table 2 (page 14) in the following section.

Appropriate energy-efficient measures

Many aspects of low-energy design have little or no capital cost implication. Indeed, some of the measures actually lead to capital cost savings! All the measures are simple to install and require little maintenance. Many of these features are highly desired by occupants and are believed to increase worker satisfaction and productivity.

Some successful attributes of low-energy design are:

- building form and structure which protect against temperature swings
- natural ventilation, improved windows and glazing systems
- simple, comprehensible but effective controls
- efficient heating, cooling and lighting plant
- well-insulated fabric
- efficient lighting and controls
- external shading to reduce summer cooling loads.

Avoid later design changes

Often the role of the QS has been interpreted as providing the 'least capital cost' option for every building component. However, this approach can frustrate the integrated design process and prevent the QS from contributing proactively to an integrated solution for performance and cost. For example, an integrated design may rely on external shading and windows which are secure while open, that allow night cooling to permit the downsizing or elimination of cooling and ventilation, plant and the adoption of a glare-free daylighting strategy. If the shading and/or the carefully specified windows are then excluded late in the design process in order to make cost savings, the design strategy for the whole building is undermined and the building could fail to operate comfortably for the rest of its life as a result.

Importance of packages of measures

Energy efficiency measures have an interactive effect on each other such that where different measures affect the same service, the energy left to save becomes progressively less with the introduction of each new measure.

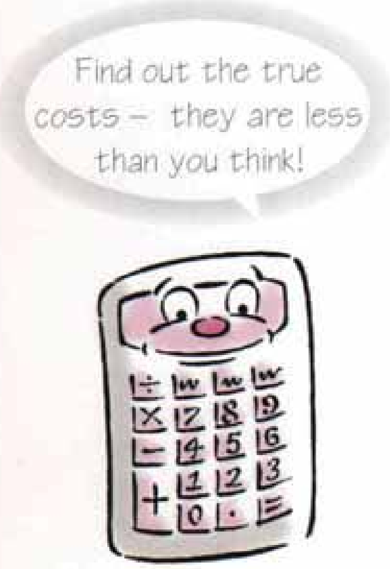
For example, if energy savings are calculated in sequence first for improving the efficiency of a heating system and then for adding thermal insulation, the energy saved by the enhancement of the heating system will apparently be greater than if it is improved after the insulation has been added. Thus the payback period is dependent on the order in which the measure is carried out and tends to make the first measures considered appear the best, even though the order may have been arbitrary.

Also, some savings only occur if several measures are in place together, so it is important to work in collaboration with a building services engineer who can evaluate the combined effect of all measures.

Payback periods should only be considered for a package of measures, not as a means of discriminating between measures.

It is crucial, at all stages of the design, that the QS considers the integrated design, and evaluates the options for cost trade-offs associated with the energy efficiency measures. Where the QS has been allowed to do this, best value for money for the client has been achieved because of, rather than in spite of, the energy efficiency measures proposed.

ENERGY EFFICIENCY MEASURES DO NOT ALWAYS COST MORE



SOME ILLUSTRATED EXAMPLES

1 Improving an air-conditioned building

This example illustrates how the capital costs and energy costs can vary as a design team pursues a number of options to value manage a low-energy solution with no capital cost penalty.

Since the QS ought to influence both the client and the design team at inception, the measures illustrated in figure 2 (opposite) commence from the inception stage. The scenario of decision-taking starts with a 'reference' air-conditioned office building specified to the following typical institutional standards:

- eight-storey office of rectangular deep-plan with atrium at centre
- four-pipe fan coil full-fresh-air air-conditioning system
- designed to typical Building Regulations and professional standards (eg CIBSE, etc)
- 60% double glazing assumed throughout.

This example has been selected to coincide in performance with a typical DETR EEBPp ECON 19[3] type 3 benchmark building. The costs of this reference case are indicated by the top pairs of bars in figures 2 and 3. The following column describes what happens at the various stages of the design process as the kind of measures shown in tables 3, 4, and 5 (pages 14 and 15) are applied cumulatively to this building.

Measures applied at inception stage

Figure 2 shows that most of the key decisions taken at inception permit significant overall cost savings as well as energy cost savings, especially the decisions to broaden the permissible temperature range and reduce ventilation rates to an acceptable 10 litres/person/sec.

The design selections used are those proposed in the British Council for Offices 'Best Practice in the specification for offices' (see page 20).

Measures applied at sketch design stage

In this stage there are also many choices that can be made which save energy and reduce capital cost, eg reducing glazing areas.

The effective use of the thermal mass, which is already provided by the structure, can avoid the need for air-conditioning by reducing overheating in summer.

However, if air-conditioning is essential, exposed soffits will save capital cost. The increase in accessible thermal mass that results from this may have a limited energy-saving benefit unless it is carefully integrated into a night cooling strategy.

Other decisions at the sketch design stage do incur additional capital cost; however these are usually repaid many times over by savings in use. In this particular case, external blind sun shading using external blinds appears expensive compared to the resulting running cost savings. However, the shading permits some of the other measures to work effectively, for example a low-glare daylighting strategy. Shading systems can also often be part of a design/aesthetic feature which adds value that is not revealed in the energy cost savings.

Measures applied at detailed design stage

Through the detailed design stages, the emphasis moves more towards decisions that spend to save, and the potential savings from each measure become progressively less. This can create the impression that the first measures selected are the best performers but, as explained above, they should be considered as a package.

FACTS

The cumulative capital cost savings of all the measures are in the region of £55/m²GFA (gross floor area); this is achieved by an increase in fabric costs of 2% and a decrease in services costs of 11%. It also achieves energy running cost savings of £3/m²GFA/year when compared with the reference building (almost a 50% saving). In addition, the reductions in carbon dioxide (CO_2) emissions that are achieved with this design would attract five credits under BREEAM.

FICTION

In a recent survey of QSs, most believed that energy-efficient buildings are more expensive to build. Only by adding all on-costs and ignoring all the trade-off savings can the improvements be considered in this way. Even on that basis the on-costs are only 4%, which is the lower bound of QS opinion in the survey.

Figure 2 clearly demonstrates that many QSs seriously overestimate the capital costs of energy efficiency measures and seriously underestimate the potential for cost savings as trade-offs.

ENERGY EFFICIENCY MEASURES DO NOT ALWAYS COST MORE

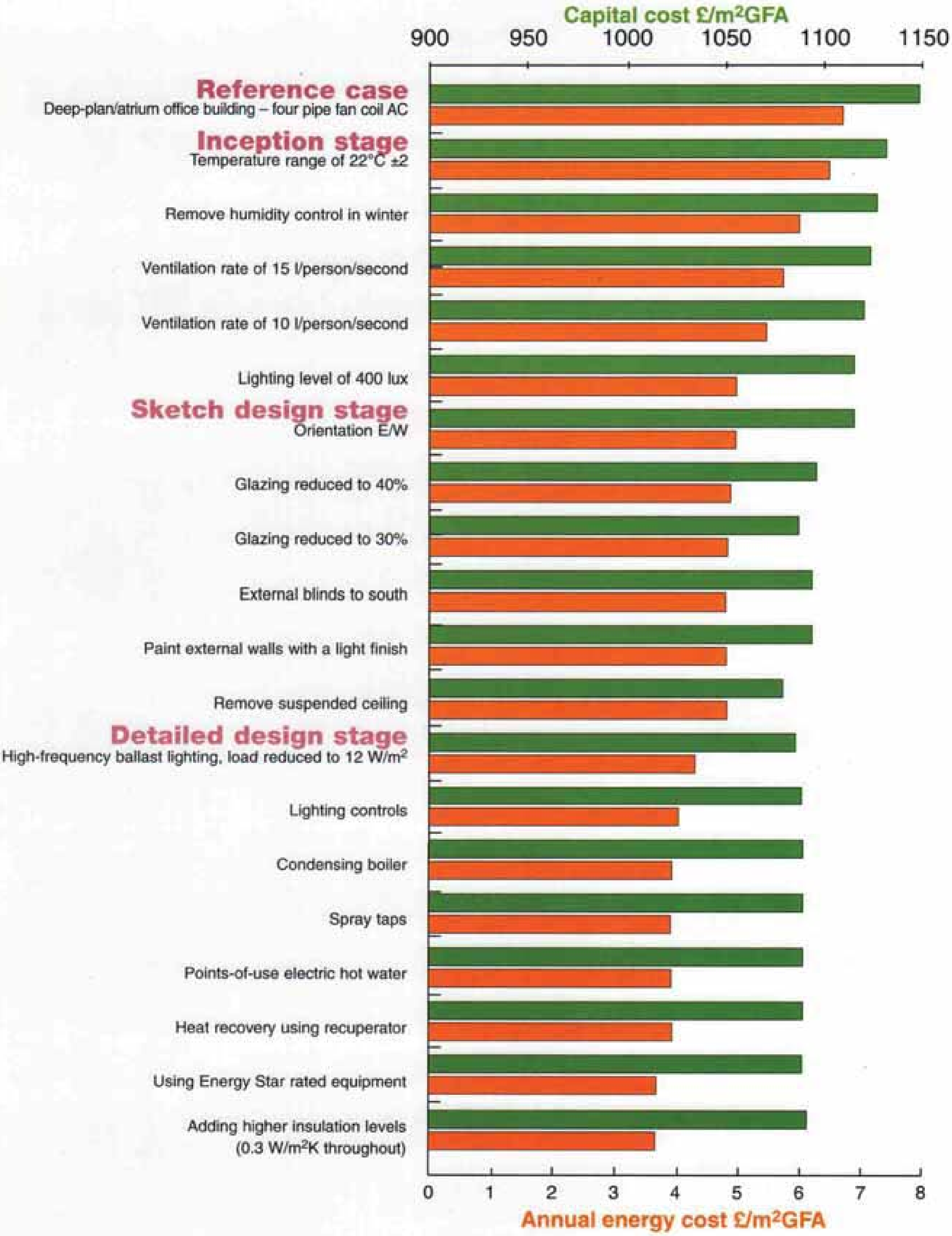


Figure 2 Value managing an air-conditioned building for energy efficiency

ENERGY EFFICIENCY MEASURES DO NOT ALWAYS COST MORE

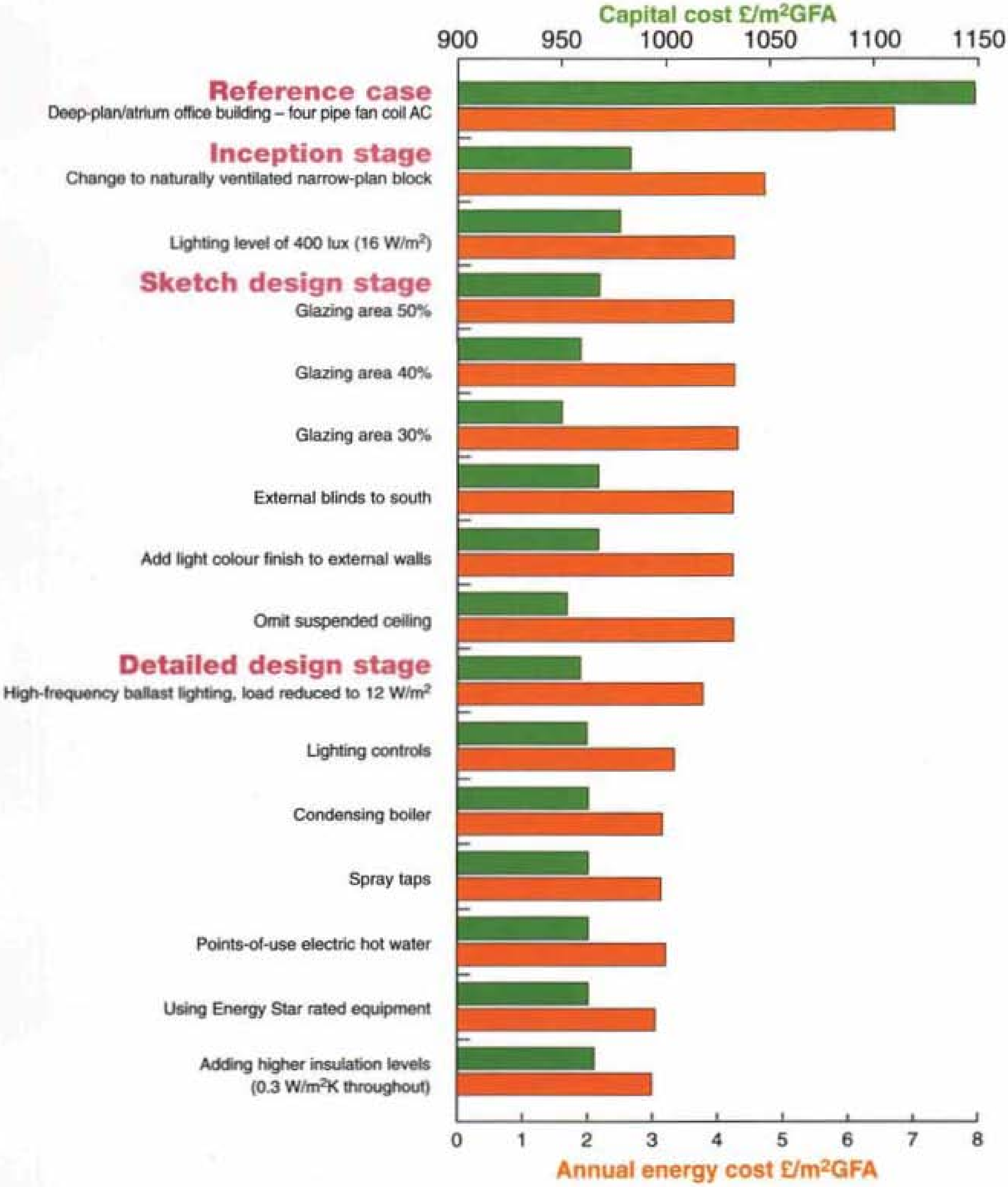


Figure 3 Capital and running cost savings achieved by changing from air-conditioned to naturally ventilated building

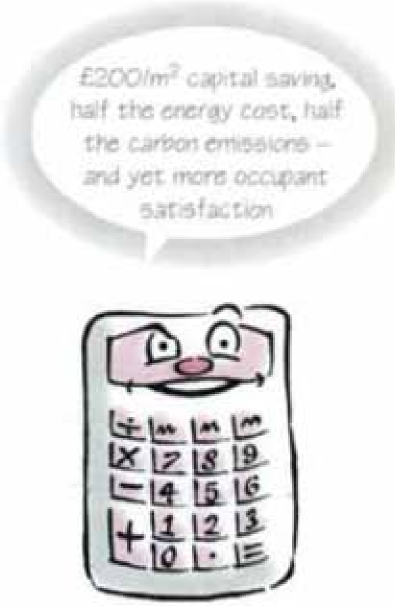
ENERGY EFFICIENCY MEASURES DO NOT ALWAYS COST MORE

2 Changing to a naturally ventilated and passively cooled building

Figure 3 (on page opposite) shows an alternative design scenario that demonstrates greater savings by adopting a naturally ventilated passively cooled strategy for the building – something that should interest the client. Such designs make better use of thermal mass and external shading. They can lead to capital cost savings of up to £200/m^{2}GFA (representing 20% of the total capital cost), and operational energy savings of about £4.0/m^{2}GFA/year (50% of the energy cost).

BEYOND COST SAVINGS

The QS should appreciate that the benefits of energy-efficient buildings are broader than mere running cost savings. They include prolonging the life of fossil fuel stocks, and reducing polluting emissions due to energy consumption. For instance, implementing all the measures in the scenario of changing from an air-conditioned specification to a naturally ventilated one would reduce both the delivered energy and CO_2 emissions by 48%. Still further benefits of value to the client come from the intrinsic aesthetic and comfort qualities of good energy-efficient buildings, eg daylight, comfort (and productivity), occupant control and satisfaction.



5 COSTS AND BENEFITS OF ENERGY EFFICIENCY MEASURES

This section provides more detail about the costs and benefits of particular energy efficiency measures at the different stages of a building project. Some measures give both capital and running cost savings. The capital cost savings figures are quoted in terms of the cost per square metre of the gross floor area (GFA). Running cost savings are generally quoted in terms of cost per year per square metre of the *treated* area, but for the purposes of this comparison GFA is used. All the figures are quoted in indicative ranges. However, in a real project, predicted energy costs for the proposed building/plant configuration should be calculated to set alongside its predicted capital cost.

Remember that all the measures discussed below need to be considered as part of an overall integrated package for a successful energy-efficient outcome. This means that the energy impact must be discussed with the building services engineer and architect during the value engineering exercise.

IMPROVEMENTS AT THE INCEPTION STAGE

To assist the QS to evaluate the trade-off options at the inception stage, sample capital cost savings and running cost savings are shown in tables 2 and 3 below for a set of measures appropriate to office buildings.

Energy-saving measures at the inception stage

An obvious measure which will save capital and operating costs all round is to avoid oversizing the building or its plant for the operational needs of its occupants. Oversized plant operates less efficiently at part-load, and costs more to install. Table 2 shows a number of other measures that also bring capital cost savings at the design stage and save running costs throughout the building's life.

IMPROVEMENTS AT THE DESIGN STAGES

To help the QS evaluate the trade-off options, tables 4, 5, 6 and 7 illustrate the financial effects of adopting a number of different services strategies at sketch design and detailed design stages. For each measure the capital cost/saving is listed together with the running cost savings. The measures are arranged roughly in the sequence in which they arise as opportunities for consideration in the construction process.

Energy-saving measures, which save both capital cost and running cost	Capital cost savings range (£/m^{2}GFA)	Running cost savings range (£/m^{2}GFA)
Minimise air-conditioning to meet needs, naturally ventilate where possible	100-500	Up to 19
Specify adequate but not excessive fresh air rates; 8-12 litres/sec/person	3-10	0.3-1.0
Control temperature less tightly	8-25	Up to 2
Avoid excessive artificial lighting	1-8	14-25
Avoid close humidity control	5-15	0.3-1.0

Table 2 Measures to consider at inception which save capital and running costs

Low capital cost energy-saving measures	Extra capital cost (£/m^{2}GFA)	Running cost savings range (£/m^{2}GFA)
Maximise daylighting in design	Up to 50	1.0-3.0

Table 3 Other low-cost measures that can be considered at inception

COSTS AND BENEFITS OF ENERGY EFFICIENCY MEASURES

Energy-saving measures, featuring both capital cost savings and energy running cost	Capital cost savings range (£/m²GFA)	Running cost savings range (£/m²GFA)
Use square plan, cubic form (but see note 1)	Up to 4	Up to 0.5
Choose sheltered location against weather	Costs and feasibility for these measures are site dependent	Site dependent
Provide good access for daylight	Neutral	Site dependent
Specify appropriate orientation for solar gain and daylighting	Neutral	Site dependent
Minimise glazing areas – but still sufficient for daylighting – say 30%	Up to 15	Up to 0.2
Expose soffit ceilings to make thermal mass accessible	Usually involves a saving depending on internal specification	Brings comfort benefits and sometimes savings
Avoid excessive floor-to-floor heights (but not at expense of undersized ventilation ducts or flexibility)	Up to 50	Up to 0.1

Table 4 Measures to consider at sketch design stage which save capital and running costs

Low-cost energy-saving measures	Extra capital cost range (£/m²GFA)	Running cost savings range (£/m²GFA)
Provide sunshading to southern elevations (also brings comfort benefits)	20-60	Up to 0.08
Zone for function and control	Depends on detailed design	Depends on detailed design
Consider buffer spaces and microclimate	Depends on detailed design	Depends on detailed design

Table 5 Other low-cost energy-saving measures at sketch design stage

Energy-saving measures, featuring both capital cost savings and energy running cost savings	Capital cost savings range (£/m²GFA)	Running cost savings range (£/m²GFA)
Chilled beams/displacement ventilation replacing fan coil	Up to 35	1.2-7.0
Ventilation floor slabs (eg Termodeck vent/heat/cooling system) replacing fan coil	Neutral	1.2-5.0

Table 6 Measures to consider at detailed design stage which save capital and running costs

COSTS AND BENEFITS OF ENERGY EFFICIENCY MEASURES

Low-cost energy-saving measures	Extra capital cost range (£/m²GFA)	Running cost savings range (£/m²GFA)
High-frequency ballast lighting <12 W/m², illumination 350-400 lux	2-10	0.3-1.0
Efficient lighting controls	1-5	0.1-0.5
Condensing boiler	0.5-1.0	0.1-0.3
High-efficiency boiler	0-0.2	0.05-0.2
Combined heat and power (co-generation)	10-30	2-7
Spray taps	Very low	0.01-0.03
Point-of-use water heating	Very low	0.02-0.15
Ventilation heat recovery system	3-5	0.02-0.1
LP ducts for air-handling system	5-12	0.3-1.0
Energy Star rated equipment and fit-out	Neutral	Up to 20% saving
Efficient thermal control systems, simple for occupant to operate	Very low	Up to 10% saving
BMS controls, assuming occupant competent to operate	30-50	2.0-10.0
Insulate to high standards – better than Building Regulations, eg 0.3 W/m²K	2-10	0.01-0.1

Table 7 Other low-cost energy-saving measures to consider at detailed design stage

NOTES

1 Other things being equal, a square plan will reduce heating consumption, but a deep square plan will increase lighting use and make air-conditioning more necessary. The effect on cooling energy use depends on the extent to which perimeter zones have above-average loads, on orientation and whether air-conditioning is avoidable or not.

2 The interdependence of energy efficiency measures can be a particular concern when a project is over-budget. If the design team are looking for cost savings later in the detail design stage they must not forget crucial strands of the energy efficiency design strategy established at sketch design stage. The effects of deletion of one measure are best assessed using an energy evaluation procedure that can take account of their interdependence, rather than using these tables.

3 The above figures will, of course, need to be confirmed by the QS when he compiles the detailed bill of quantities based on final equipment selections and contracted prices.

7 SUMMARY

Energy efficiency is not expensive.	Buildings which are energy efficient have significantly lower life-cycle costs than buildings which are not. Effective and appropriate packages of energy efficiency measures pay back investment costs quickly (if there are any) and then contribute to long-term savings. Some measures are cost neutral or even capital cost saving.
Energy efficiency is not an optional extra.	Energy efficiency is an important indicator of the environmental quality of a project and of its sustainability. A market survey to assess the uptake of the BREEAM environmental rating showed that organisations receive good public relations coverage and enhanced corporate image by building/occupying an environmentally friendly building. Many ethical investment organisations perceive 'green' buildings to be appropriate investments for them, to retain a high market/rental value and guard against future attitude changes against profligate buildings.
The QS must understand the client's expectations of energy efficiency in terms of investment returns.	When assessing the life-cycle cost of energy efficiency investments, it is important to select appropriate test discount rates and payback timescales for the investing organisation (see section 3, page 6). Decisions on energy efficiency options should never be made simplistically in terms of payback. Further information on financial appraisal techniques is available in Good Practice Guide (GPG) 165.
The QS needs to take a proactive role in energy efficiency in order to provide a value management service to clients.	The QS has traditionally regarded energy efficiency matters to be the concern of the architect and the building services engineer. Mechanical and electrical (M&E) services are a significant proportion of the costs of new office buildings, and energy efficiency is interwoven with many aspects of the building shape and specification, so the QS needs to have an appreciation of the viable energy efficiency techniques to get best value for clients.
The QS needs to get involved at the inception stage of a building project.	The QS is a key member of the design team and can crucially affect the outcome of a project in terms of its energy efficiency and thereby its environmental impact. The QS is influential at the sketch design and at the detailed design stages but also, most significantly, at inception when key decisions are made regarding the design brief and the project budget. At inception, the QS can propose measures that have both lower capital cost and lower running costs for the project buildings.
At the sketch design stage the QS can help maximise value for money by encouraging an integrated design.	At the sketch design stage key decisions are made about the shape, orientation, site layout and positioning, glazing areas on elevations, aesthetic qualities and environmental attributes of project buildings. The QS should aim to obtain best value for money rather than least capital cost for the client and achieve this because of an integrated energy-efficient design rather than in spite of it.
Energy efficiency should be viewed as part of a building's quality and value.	For many attributes, value to the client cannot be expressed in financial terms. There is, therefore, a tendency to underestimate the importance of quality, function, aesthetic, comfort and the environmental attributes of a project. Energy efficiency is inextricably linked to all of these issues and should have a high priority in the design team's work. Significant opportunities can be lost where energy efficiency is seen as an expensive add-on, rather than integral to delivering value and quality in the design process.

REFERENCES AND FURTHER READING

DETR ENERGY EFFICIENCY BEST PRACTICE PROGRAMME DOCUMENTS

The following publications are available from the Best Practice programme Enquiries Bureaux. Contact details are given on the back cover.

REFERENCES

[1] Good Practice Guide 258, 'A developer's guide to environmentally smart buildings'

[2] Good Practice Guide 186, 'Developing an effective energy policy'

[3] Energy Consumption Guide 19, 'Energy use in offices'

[4] Good Practice Case Study 1, 'Energy efficiency in offices. Low cost major refurbishment. Policy Studies Institute, 100 Park Village East, London NW1'

[5] Good Practice Case Study 21, 'Energy efficiency in offices. One Bridewell Street, Bristol. A new high quality air conditioned office with low energy costs'

[6] New Practice Final Report 106, 'The Elizabeth Fry Building, University of East Anglia – feedback for designers and clients'

OTHER PUBLICATIONS

General Information Report

30 A performance specification for the energy efficient office of the future

56 Mixed-mode buildings and systems – an overview

Good Practice Guide

165 Financial aspects of energy management in buildings

New Practice Final Report

102 The Queens Building, De Montfort University – feedback for designers and clients

FURTHER READING

'Best Practice in the specification for offices. Second Edition'. British Council for Offices, Reading, 1997. ISBN 0 9524131 24

'SPONS Architects and Builders Price Book'. E & F N Spon, London

'SPONS Mechanical and Electrical Price Book'. E & F N Spon, London

'Setting Standards in the Construction Industry – The Stanhope Approach'. Stanhope plc, London

Cost models

'City of London Office Blocks'. *Building*, 14 October 1994

'The Davis Langdon and Everest Initial Estimator'. *Building*, January 1997

'Offices of the Future'. *Procurement*, September 1996

'High Rise Office Towers'. *Procurement*, May 1997

'Combined Heat and Power'. *Building Services*, January 1997

Further sources of advice and information

Chartered Institution of Building Services Engineers (CIBSE)
Delta House
222 Balham High Road
London SW12 9BS
Tel 020 8675 5211
Fax 020 8675 6554
Website: www.cibse.org

Royal Institution of Chartered Surveyors (RICS)
12 Great George Street
Parliament Square
London SW1P 3AD
Tel 020 7222 7000
Fax 020 7222 9430
Website: www.rics.org.uk

British Council for Offices (BCO)
Shinfield Grange
Cutbush Lane
Shinfield, Reading
Berkshire RG2 9AF
Tel 0118 988 5505
Fax 0118 988 5495
Website: www.bco.org.uk

The Department of the Environment, Transport and the Regions' Energy Efficiency Best Practice programme provides impartial, authoritative information on energy efficiency techniques and technologies in industry and buildings. This information is disseminated through publications, videos and software, together with seminars, workshops and other events. Publications within the Best Practice programme are shown opposite.

For further information on:

Buildings-related projects contact:
Enquiries Bureau
BRECSU
BRE
Garston, Watford, WD2 7JR
Tel 01923 664258
Fax 01923 664787
E-mail brecsuenq@bre.co.uk

Industrial projects contact:
Energy Efficiency Enquiries Bureau
ETSU
Harwell, Oxfordshire
OX11 0RA
Tel 01235 436747
Fax 01235 433066
E-mail etsuenq@aeat.co.uk

Internet **BRECSU** – http://www.bre.co.uk/brecsu/
Internet **ETSU** – http://www.etsu.com/eebpp/home.htm

Energy Consumption Guides: compare energy use in specific processes, operations, plant and building types.

Good Practice: promotes proven energy-efficient techniques through Guides and Case Studies.

New Practice: monitors first commercial applications of new energy efficiency measures.

Future Practice: reports on joint R&D ventures into new energy efficiency measures.

General Information: describes concepts and approaches yet to be fully established as good practice.

Fuel Efficiency Booklets: give detailed information on specific technologies and techniques.

Introduction to Energy Efficiency: helps new energy managers understand the use and costs of heating, lighting, etc.